Detroit Water and Sewerage Department

Wastewater Master Plan

DWSD Project No. CS-1314

Review of Wastewater Quality and Industrial Pretreatment

Technical Memorandum
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Review of Wastewater Quality and Industrial Pretreatment

1. Introduction

The objectives of this task are to identify wastewater quality issues and regulatory limits and constraints pertinent to the expansion of existing treatment facilities and/ or the construction of new treatment facilities in the DWSD service area. The scope of this task is to determine the pretreatment rules and procedures applied by DWSD to the Significant Industrial Users (SIUs) of the wastewater collection system, to assess and present statistical information on the pollutants monitored as part of the Industrial Pretreatment Program (IPP), and to compare the quantities of these pollutants discharged to the sewer system over the years. Also included is a review of the information produced to date on CS-1295, "Pretreatment Information Management System". As part of this effort, the available information in the possession of DWSD was identified and, where possible, was gathered from the Office of Program Management Assistance (OPMA) and the Industrial Waste Control Division (IWC) in DWSD. This information was reviewed and the relevant portions are presented below. This information may be used in the consideration of the expansion of existing wastewater treatment facilities and/ or the construction of new treatment facilities in the DWSD service area.

One of the primary objectives of this memorandum was to determine whether there is sufficient information available to make a distinction between the quality of the wastewater north and south of Eight-Mile Road. The latter is the principal boundary between the suburban flows from Macomb and Oakland Counties, and the City of Detroit and other Wayne County flows. This objective proved to be unattainable due to the lack of information on the individual SIUs and on sampling of wastewater in the collection system. The data on SIU sampling which is regularly carried out by IWC on each SIU and independently by each SIU is not readily available.

The first part of this task was to determine the location and availability of the required information within the DWSD. The following sources were identified in the scope of work for this task as being relevant sources of information for the work to be performed in this task:

1. All DWSD "Summary of Operating Statistics of the Detroit Water and Sewerage Department" for the years 1980 – 2000. (Obtained from OPMA)

2. All available (OPMA) "Annual Pretreatment and Sampling Reports". (Obtained from OPMA)

3. DWSD Contract CS-1295 "Pretreatment Information Management System". This contract consists of the following two documents, which were obtained from the consultant for CS-1295; the "Functional Requirements Specification" (September 25, 2000) and the "Development and Implementation Plan" (October 23, 2000).

4. All available reports and studies that have given details of wastewater quality north and south of Eight Mile Road. (Obtained from OPMA and IWC)

The inquiry into the availability of other reports relevant to this task (item 4 above) revealed several studies of interest. These are as follows:

- "Re-evaluation of Local limitations for Compatible Substances Volume I: Maximum Allowable Headworks Loadings", (MacNamee, Porter & Seeley Inc., 1995)
- "Re-evaluation of Local limitations for Compatible Substances Volume II: Development of Local Limits", (MacNamee, Porter & Seeley Inc., 1995)
- "Re-evaluation of Local limitations for Incompatible Substances Volume I: Maximum Allowable Headworks Loadings", (MacNamee, Porter & Seeley Inc., 1995)
- "Re-evaluation of Local limitations for Incompatible Substances Volume II: Development of Local Limits", (MacNamee, Porter & Seeley Inc., 1995)
- "PCB/ Mercury Minimization Program Update" for the years 1994 through 2000 (OPMA various years).
- City of Detroit Water and Sewerage Department Industrial Waste Control Division, Ordinance 34-96 Division 3: Wastewater Discharge Control.

This memorandum is organized in several sections. It starts with this introduction which outlines the scope of the task; the second section describes and presents the results of the review of the documents mentioned in the introduction. The latter presents some tables and figures showing a summary of data obtained from the documents reviewed. The third section provides comments and conclusions where appropriate. The fourth section contains a list of the references reviewed and consulted in the document.

2. Documents Reviewed

The documents listed below have been reviewed and where appropriate the data have been analyzed to provide the information relevant to this task.

2.1 Summary of Operating Statistics of the Detroit Water and Sewerage Department

The OPMA provided copies of annual reports entitled "Summary of the Operating Statistics of the Detroit Water and Sewerage Department" for the years 1980 through 2000.

Each of these documents provides a statistical overview of the DWSD operations for a 12-month period from July 1 to June 30 (DWSD Fiscal Year). For this task, the sections dealing with the activities of the Sewerage Division were reviewed. The sections of direct relevance to this task are the following:

- Schedule of Surcharge Rates (Sewage Rates applied to Industrial Users whose effluent exceeds a given strength or concentration)
- Industrial Waste Control Division, Industrial Pretreatment Program Operating Statistics
- WWTP Operating Statistics

2.2 Industrial Pretreatment Program Annual Reports

These reports are submitted annually to MDEQ as part of the DWSD NPDES permit. They give an overall picture of the activities under the program for the calendar year. The information listed includes the following:

- Number of Categorical Industrial Users, Significant Noncategorical Industrial Users, Total number of Industrial Users.
- Significant Industrial User Compliance.
- Compliance Monitoring Program.
- Enforcement Actions.
- WWTP effluent sampling results.

The information contained is very general and does not provide any indication of water quality in the sewer system or in the effluent discharged by the SIUs. Only the average annual characteristics of the wastewater at the influent and effluent at the WWTP are provided.

The review of the annual "Summary" has yielded some information on the performance of the WWTP through the information noted above. Each year there is a statement of the average characteristics of the influent and effluent at the plant. The review of the annual statistics for the period 1980 to 1998 has yielded a number of tables and charts. The tables that follow show the

Table 1 below lists the values for Annual Sewage Volume, and for the following four wastewater characteristics, Total Suspended Solids (TSS), 5-day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Total Phosphorous (Total-P), and Fats, Oil and Grease (FOG) for the period between 1980 and 1998. These are the four Substances of Concern listed in DWSD's NPDES Permit for which the Permit sets limits in the effluent discharged by the WWTP.

The relationships between the pumped sewage volume as well as the four wastewater characteristics in the influent and the effluent versus time are shown in Figures 1 through 5, as described below:

- Figure 1 shows the Annual Volume in MG pumped through the WWTP.
- Figure 2 shows the Average Annual Total suspended Solids (TSS) in the WWTP influent and effluent streams, and the reduction of TSS due to treatment processes in the WWTP. The data show that the plant is consistent over the long term in reducing TSS.
- Figure 3 shows the $CBOD_5$ values in the WWTP influent and effluent. As with the TSS the figure shows a good consistency in removing the $CBOD_5$ before discharge to the Detroit River wastewater. The highest value is approximately 50% greater than the lowest.
- Figure 4 shows the Total Phosphorous (Total-P) in the WWTP influent and effluent. Similarly with the TSS the figure shows a good consistency in removing the Phosphorous before discharge to the Detroit river
- Figure 5 shows the Fats, Oil and Grease (FOG) Solids, the figure shows a good consistency in removing in the WWTP influent and effluent. As with the Total Suspended the $CBOD_5$ before discharge to the Detroit river

Table 1. Wastewater Treatment Plant Annual Operating Statistics

Fat, Oil and Grease (FOG)			Total Phosphorus (Total-P)			Carbonaceous Biological Oxgen Demand (CBOD5)			Total Suspended Solids (TSS)			Sewage Pumped (MG)	Fiscal Year
Reduction	Effluent	Influent	Reduction	Effluent	Influent	Reduction	Effluent	Influent	Reduction	Effluent	Influent		
(%)	(mg/l)	(mg/l)	(%)	(mg/l)	(mg/l)	(%)	(mg/l)	(mg/l)	(%)	(mg/l)	(mg/l)		
70.5	12.3	42.9	57.2	1.66	3.9	65.0	41.0	117.4	64.2	64	194.8	234,000	1980
67.4	7.6	27.9	77.2	1.32	7.6	66.8	37.0	123.9	64.9	52	195.0	241,000	1981
81.4	3.5	25.3	84.7	0.57	4.0	87.1	13.0	116.2	84.4	23	177.6	250,000	1982
80.3	4.0	31.0	82.1	0.73	4.4	86.1	14.0	118.3	86.2	22	194.2	245,700	1983
76.1	5.5	23.0	81.9	0.79	4.4	83.1	19.0	112.2	86.1	27	193.8	257,400	1984
65.1	5.3	19.4	83.6	0.65	4.4	89.0	10.0	111.1	88.5	20	198.5	252,800	1985
71.3	5.6	19.5	81.2	0.76	4.0	90.3	10.0	102.9	90.3	18	185.9	268,100	1986
69.1	5.2	16.8	81.8	0.80	4.2	94.7	6.0	112.8	93.1	13	188.6	260,300	1987
79.4	5.2	25.2	82.6	0.79	4.5	94.5	7.0	128.4	93.5	13	201.2	263,500	1988
79.8	5.1	25.3	83.9	0.69	4.3	95.4	6.0	130.0	93.1	13	189.0	259,800	1989
72.6	5.5	20.1	79.2	0.73	3.5	93.5	7.0	108.0	91.2	14	160.2	295,400	1990
67.3	5.3	16.2	72.8	0.84	3.1	93.3	7.0	104.0	90.1	15	152.0	300,700	1991
74.5	5.4	21.2	76.0	0.81	3.4	92.6	7.0	94.0	90.1	15	151.0	280,900	1992
78.9	5.1	25.1	72.0	0.85	3.0	89.3	9.0	84.0	89.4	15	141.0	269,000	1993
74.5	5.1	20.3	67.8	0.98	3.1	83.5	16.0	97.0	84.9	21	139.0	254,700	1994
75.2	5.3	21.4	73.8	0.75	2.9	89.6	10.0	96.0	85.0	22	147.0	255,100	1995
80.2	5.3	26.8	79.7	0.61	3.0	91.4	8.0	93.0	88.8	18	161.0	259,900	1996
78.0	5.7	25.9	80.1	0.79	4.0	87.5	13.0	104.0	88.9	21	189.0	267,100	1997
75.8	5.4	22.3	n/a	n/a	4.0	91.0	10.0	111.0	88.3	23	197.0	250,600	1998
74.6	5.7	24.0	77.6	0.8	4.0	87.6	13.2	108.6	86.4	22.6	176.6	261,368	Average
81.4	12.3	42.9	84.7	1.7	7.6	95.4	41.0	130.0	93.5	64.0	201.2	300,700	Maximum
65.1	3.5	16.2	57.2	0.6	2.9	65.0	6.0	84.0	64.2	13.0	139.0	234,000	Minimum
1.25	3.51	2.65	1.48	2.91	2.66	1.47	6.83	1.55	1.46	4.92	1.45	1.29	Max/Min

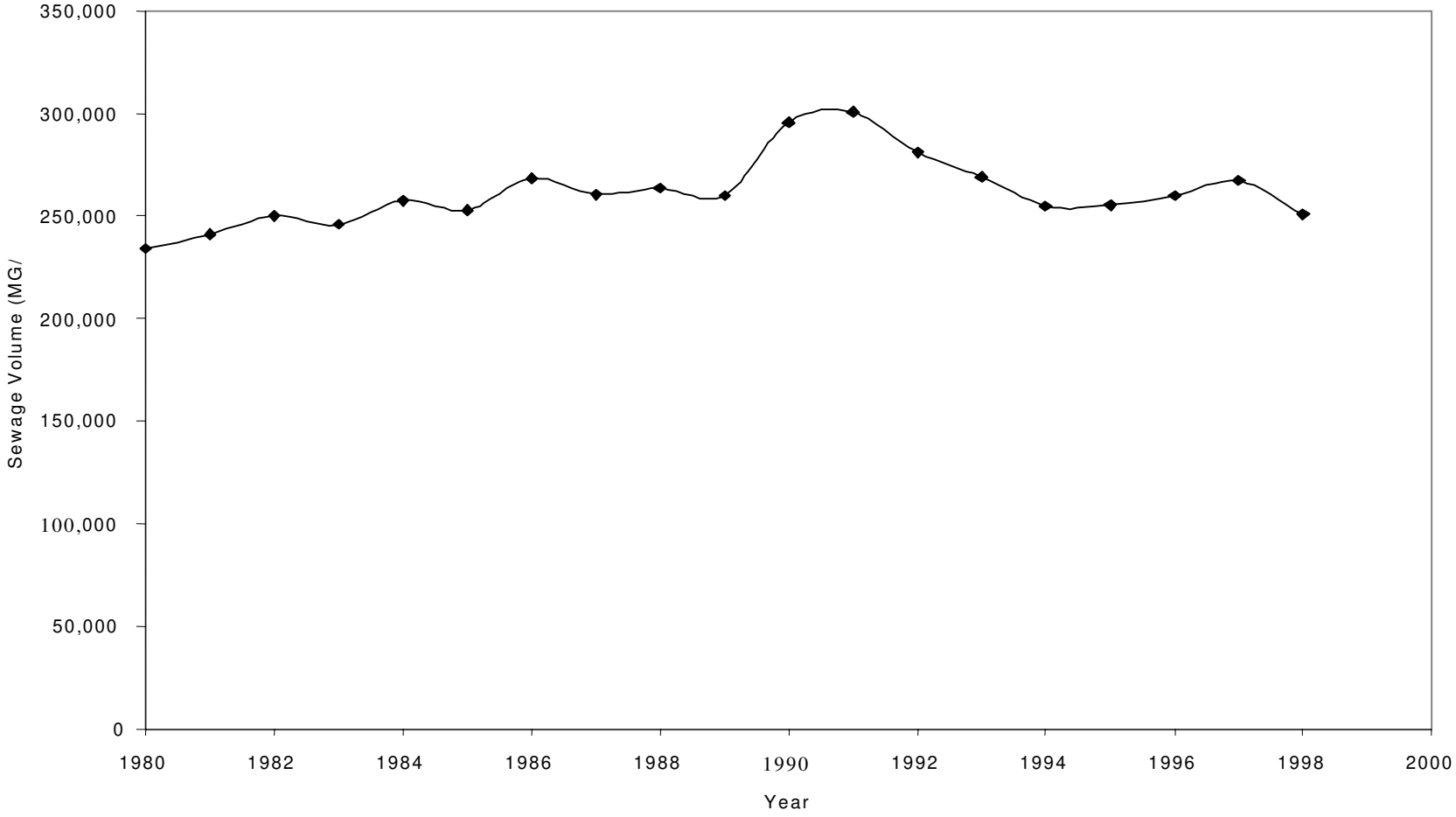

Figure 1. Sewage Volume at the DWSD Wastewater Treatment Plant

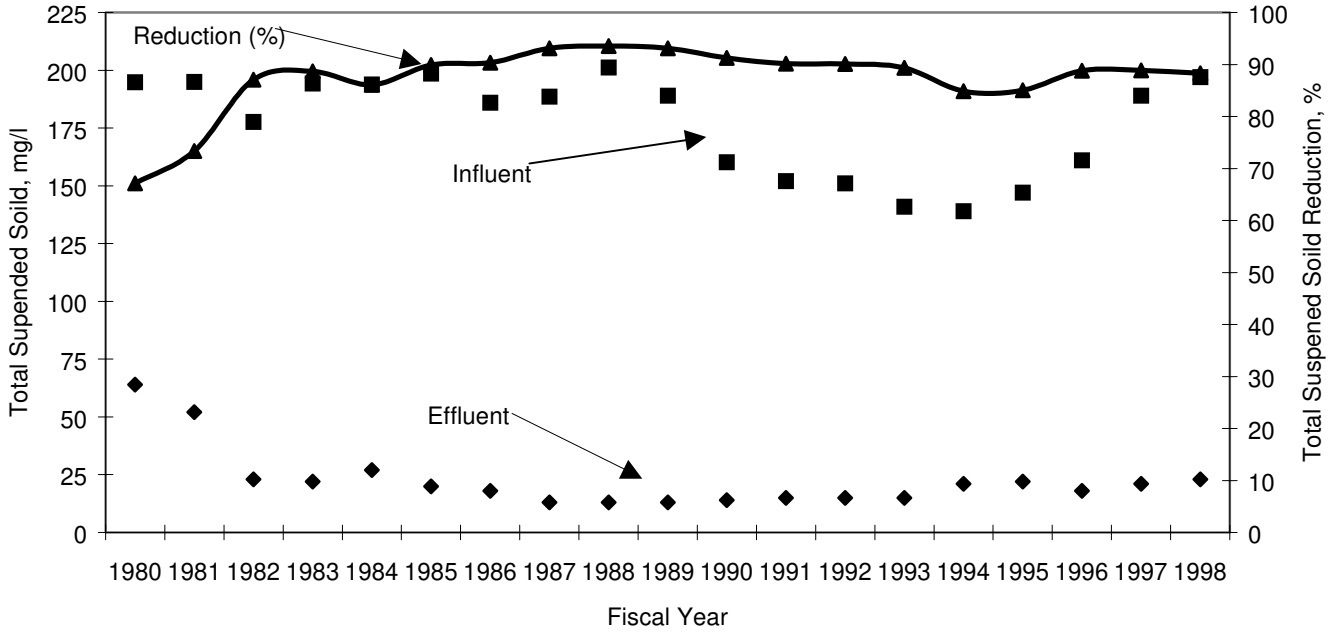

Figure 2. Total Suspended Solids (TSS) Treatment at DWSD Wastewater Treatment Plant

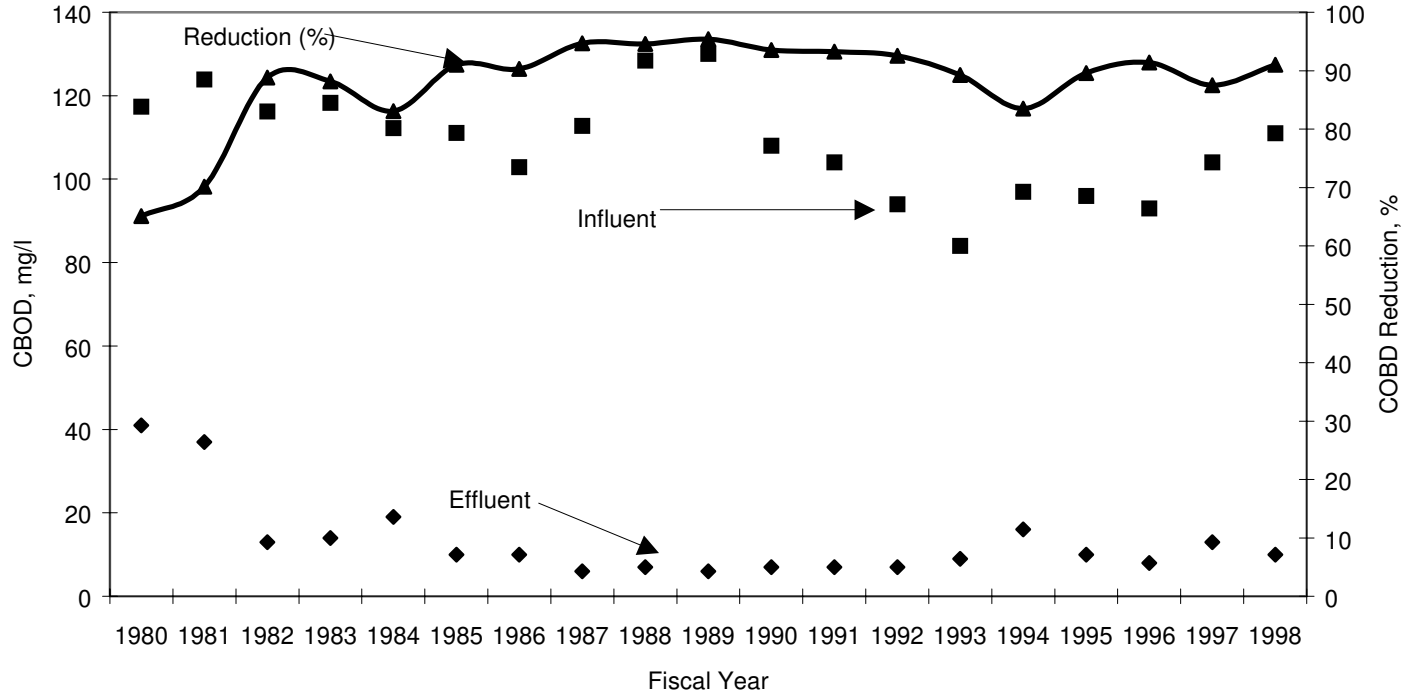

Figure 3. $CBOD_5$ Treatment at DWSD Wastewater Treatment Plant

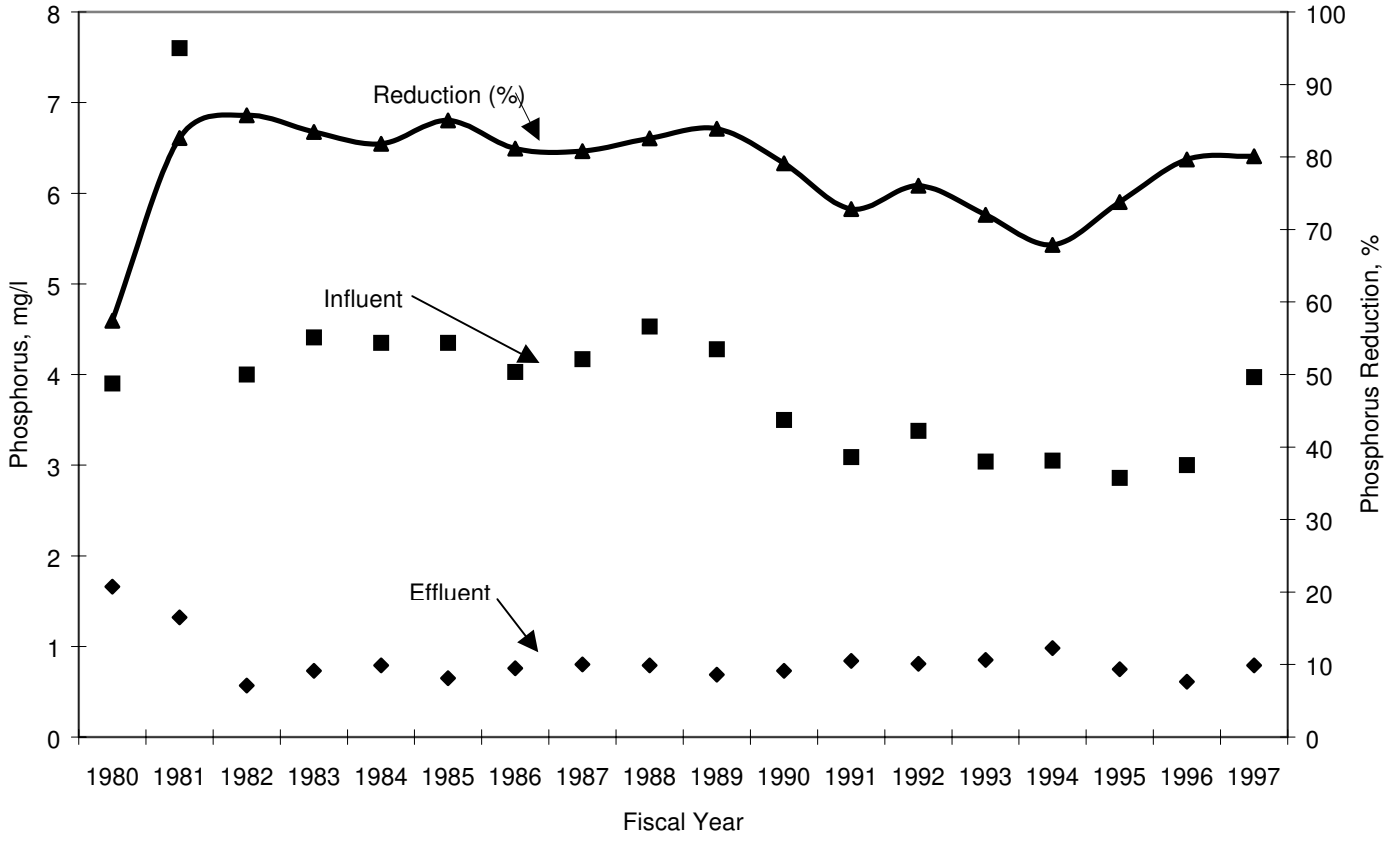

Figure 4. Total Phosphorus (Total-P) Removal at DWSD Wastewater Treatment Plant

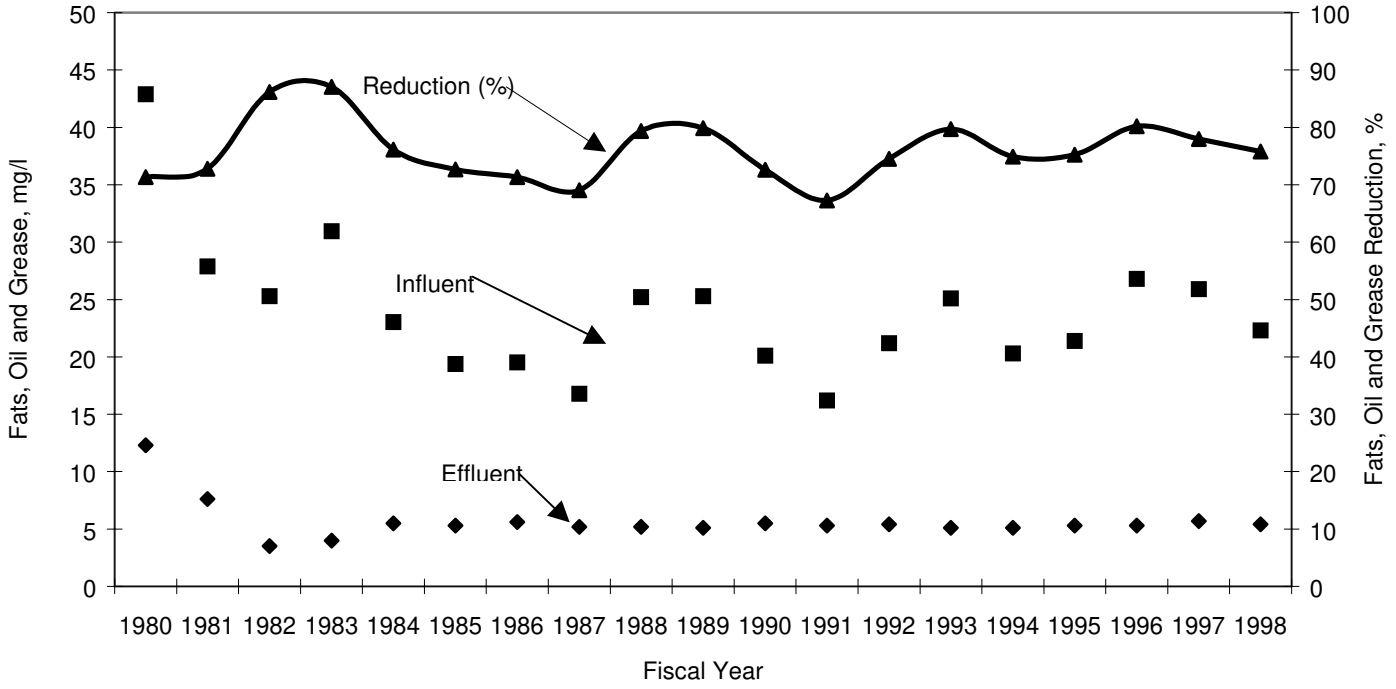

Figure 5. Fats, Oils and Grease (FOG) Removal at DWSD Wastewater Treatment Plant

- Figure 6 shows no clear trend in the number of significant violations after the first three years of the IPP. The number of significant violations has varied roughly between 5% and 18% of the total SIUs in the DWSD service area.

- Figure 7 shows that the amount of fines and fees collected under the IPP permits has ranged between $10,000 and $482,000 since the beginning of the program. The IWC Division collected approximately $433,000 in 1996 and $482,000 in 1999, the most recent data available at the time of writing.

- Figure 8 shows the data on spill incidents, which are only available for three years. It is hard to draw any conclusions from this short period of data. The conclusion that appears to be possible is that the number of spill incidents reported was steady for two of those three years.

2.3 Industrial Waste Control Division Annual Reports

The IWC Division publishes an Annual Report each year detailing the activities of the IPP. The report is formatted to comply with the reporting requirements of the MDEQ's regulations and Federal Law 40 CFR 403.12(i). This report comes in three volumes.

The reports available during the preparation of this memo were for the years from 1988 to 1998. These reports give printouts from the IWC database of names and addresses of the SIUs in the system, tables of the notifications sent to SIUs which violated the conditions of their discharge permits, a list of spill incidents reported to IWC and/ or investigated by the Division and data from a survey of the status of Industrial sites conducted by mail by IWC. These data do not contain data on the quality of the effluent discharged by each permit holder and were therefore of limited use in this task.

2.4 Re-evaluation of Local Limitations for Compatible and Incompatible Substances

The IWC Division of DWSD commissioned a study to evaluate the impact of compatible and incompatible substances on the efficiency of wastewater treatment operations at the Wastewater Treatment Plant (WWTP). The documents pertaining to this study consist of the following four volumes:

- "Re-evaluation of Local limitations for Compatible Substances Volume I: Maximum Allowable Headworks Loadings"

- "Re-evaluation of Local limitations for Compatible Substances Volume II: Development of Local Limits"

- "Re-evaluation of Local limitations for Incompatible Substances Volume I: Maximum Allowable Headworks Loadings"

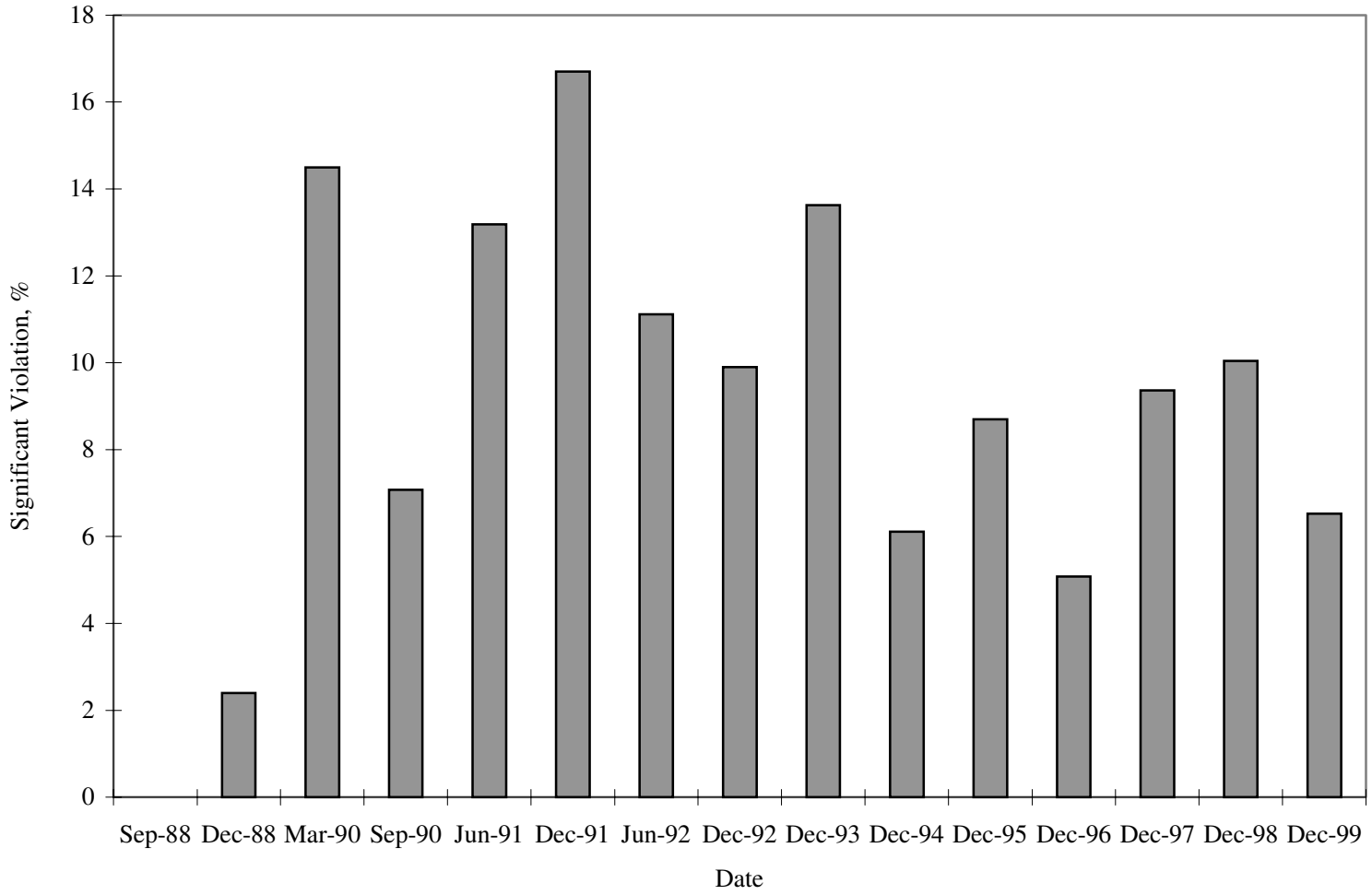

Figure 6. Significant Industrial Users (SIUs) Violations, %

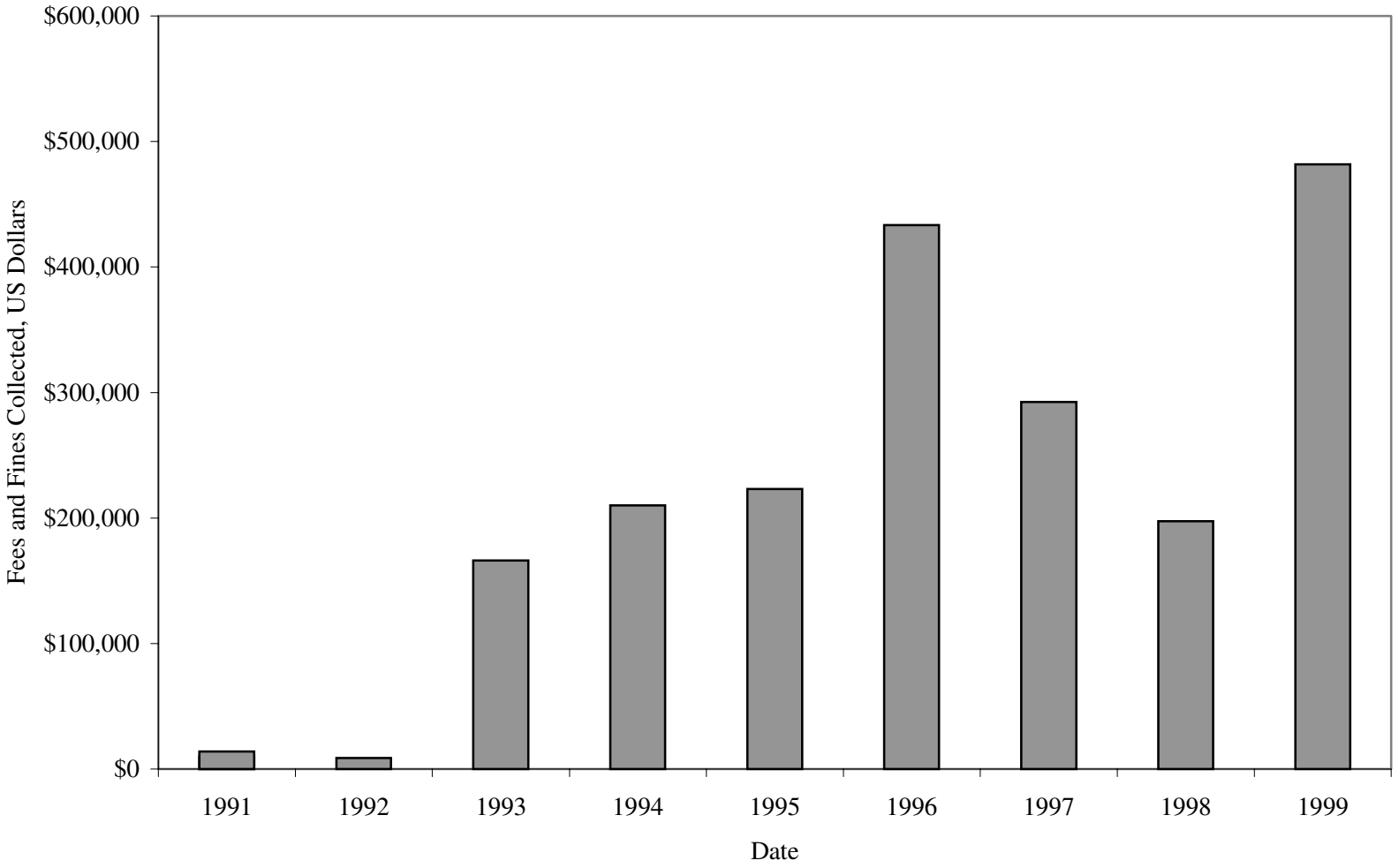

Figure 7. Fees and Fines

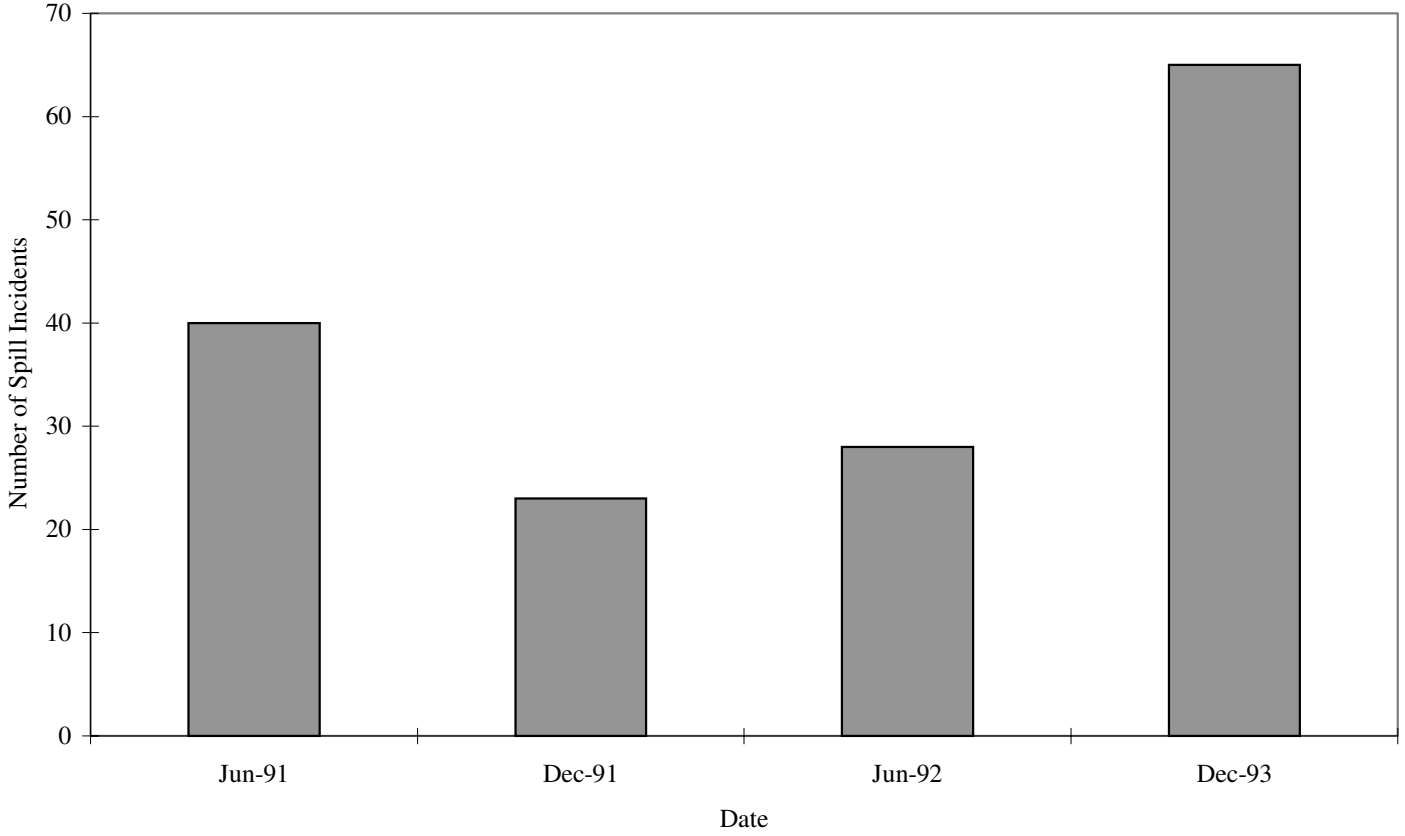

Figure 8. Spill Incidents

- "Re-evaluation of Local limitations for Incompatible Substances Volume II: Development of Local Limits".

The study was completed in 1995. The objective of this study was to establish the limits on the amounts of various substances in the incoming sewage which if exceeded will have an adverse impact on the treatment operations of the WWTP, and their results on the quality of the final effluent discharged to the Detroit River and/ or the sewage sludge produced for incineration at the WWTP. Once these limits were established, the limits to be applied in the SIU permits were then established.

The study had two major components. The first was for compatible substances; i.e. those substances that are considered to be normal primary constituents of wastewater and are allowed to be present in the final effluent based on the permits regulating the operation of the WWTP. The second was for incompatible substances, i.e. those substances which ideally should not be present in wastewater and are highly toxic to human and aquatic organism health. In each case, a set of currently regulated parameters was identified and supplemented by parameters that DWSD is considering adding to it's Local Sewer Ordinance. The procedure involved two processes. The first was to establish the maximum weight per day for each substance in the sewage inflow at the entrance to the WWTP or the Maximum Allowable Headworks Loadings (MAHL). The second was to establish limits to be applied in permits issued to SIUs based on the MAHLs calculated in the first step. The calculation of the MAHLs was based on the design flow of 930 MGD for secondary treatment at the WWTP and on several other criteria depending on which substances were being considered, i.e. compatible or incompatible.

- The criteria for compatible substances were as follows:
- NPDES pass-through limits as set by EPA and the State of Michigan.
- Controlling MAHLs.
- Critical influent concentrations.

The NPDES permit limits required that pass-through limits be calculated on a 30-day and a 7-day basis. The parameters selected were:

- Substances of Concern: four were identified in the NPDES permit Substances of Concern list (BOD, TSS, Total-P, FOG). The study also considered two Substances of Concern (Chemical Oxygen Demand (COD), Total Potassium and Nitrogen (TKN)) which DWSD is planning to add to the Pretreatment Program and were not in the NPDES Permit.
- Flow Parameters: the WWTP secondary design flow of 930 MGD.

- WWTP Effluent Quality: the limits for the four substances in the NPDES permit are set in the permit. For the remaining two substances, the study used the existing permit limits or the Michigan Water Quality Standards as a basis.

- WWTP Removals: existing monitoring data was used to determine the removal efficiencies of the WWTP.

Based on the above procedures the MAHLs were calculated for the six Substances of Concern. The calculated MAHLs are listed in Table 2 below:

Table 2. Calculated Maximum Allowable Headworks Loadings

Substance	L30 avg lb./day	L7 avg lb./day	Ldesign lb./day	MAHL lb./day
BOD5* *	1.96 x 106	1.56 x 106*	1.69 x 106	1.56 x 106
COD	4.52 x 106*	4.85 x 106	N/A	4.52 x 106
TSS	1.90 x 106*	1.96 x 106	2.23 x 103	1.90 x 106
Total-P	76,700*	N/A	210,000	76,700
FOG	N/A	538,000*	N/A	538,000
TKN	126,000*	296,000	323,000	126,000

Notes
n/a Not Applicable
* Indicates controlling value
** Assumed equivalent to CBOD5 for NPDES limit pass-through criteria

In each case the applicable MAHL is the lowest value determined by any of the four criteria used to calculate the MAHL.

The criteria for incompatible substances were as follows:

- NPDES permit discharge limits as set by EPA and the State of Michigan.

- Chronic and Acute Aquatic Toxicity in the receiving waters based on EPA and State of Michigan limits.

- Secondary Treatment Inhibition based on the best technical literature available.

- Sludge Quality for Incineration based on EPA and State of Michigan limits for air quality.

Calculation procedures for determining the MAHL were based on these four criteria. The study then identified the values of the parameters in each calculation based on the published regulatory requirements for effluent constituents, and data on the actual performance of the WWTP for removal efficiencies. It also selected six Substances of Concern for which MAHLs would be established.

The study then established the MAHLs for these six wastewater constituents on a daily basis (lb./ day) and on a concentration basis (mg/ l).

The incompatible substances and their MAHLs are listed in Table 3 below:

Table 3. Summary of Headworks Loading Criteria for Incompatible Substances

Substance	NPDES Permit Pass-Through lb./day	Aquatic Toxicity Pass-Through lb./day	Secondary Treatment Inhibition lb./day	Sludge Quality for Incineration lb./day
Inorganics:				
Arsenic	n/a	460*	767	2,127
Cadmium	138*	163	9,020	1,026
Chromium (Total)	n/a	19,500	10,500*	42,500
Copper	1980*	1,990	4,920	n/a
Cyanides	n/a	757*	21,000	n/a
Lead	685*	704	8,920	14,600
Mercury	9.20×10^{-3}	0.184	852	141
Nickel	n/a	4,730	4,460*	3.32×10^{6}
Silver	n/a	249*	2,400	n/a
Zinc	n/a	15,900	5,250*	n/a
Beryllium	n/a	n/a	n/a	0.275*
Chromium (Hexavalent)	n/a	1,100*	3,633	n/a
Cobalt	n/a	15,100*	n/a	n/a
Organics:				
Total Phenols	n/a	2,380*	33,300	n/a
Total Polychlorinated Biphenyls	1.94×10^{-3}*	4.31×10^{-2}	n/a	n/a
PCB Arochlor 1260	n/a	N/A	n/a	n/a
Acrylonitrile	n/a	1,200*	n/a	n/a
Hexachlorobenzene	n/a	23.0*	43,600	n/a
Octachlorostyrene	n/a	N/A	n/a	n/a
Styrene	n/a	24,900*	n/a	n/a
1,1,2,2-Tetrachloroethane	n/a	24,000*	n/a	n/a
Tris (2,3-Dibromopropyl) Phosphate	n/a	n/a	n/a	n/a

Notes
n/a Not Applicable
* Indicates controlling value
** Assumed equivalent to CBOD5 for NPDES limit pass-through criteria

In each case the applicable MAHL is the lowest value determined by any of the four criteria used to calculate the MAHL.

The establishment of the MAHLs was the first step in the process of determining the local limits to be applied in the permitting of Industrial Users.

Once this objective was completed the next objective was to appropriately allocate the MAHLs between the various dischargers to the sewer system, principally between the domestic/ commercial users and the SIUs.

The program in force at the time of the study established effluent concentrations for four Substances of Concern (BOD_5, TSS, Total-P, FOG). There were two levels of concentration in the program.

The first was the Surcharge Threshold Level which is the concentration at which a user begins to pay a surcharge on top of the regular sewer rate. This level is set at the concentration of a strong domestic effluent in order to reflect the extra treatment at the WWTP required to deal with the wastewater from a given user. The second limit was the Surcharge Upper Limit, i.e. the maximum concentration permissible for any of the Substances of Concern in a user's wastewater discharge to the DWSD sewer system. It was decided that the existing Surcharge Threshold Level would be used for the four Substances of Concern (BOD_5, TSS, Total-P, FOG) in the program in 1995 and to calculate levels for the two remaining Substances (COD, TKN) being considered for addition to the program.

The study considered five methods to allocate the MAHLs for the compatible substances. The study notes that the method used to allocate MAHLs is at the discretion of the local sewer authority according to Federal law as long as the final effluent criteria set out in Federal regulations are met at the discharge from the local sewer system to a receiving water. These five methods are:

- Uniform Allocation Method
- Industrial Contribution Method
- Tiered Allocation Method
- Mass Proportion Method
- Selected Industrial Reduction Method

The last two methods were discarded because the number of nondomestic users was insufficient. The third method was deemed not applicable, as there were no SIUs in the system with categorical limits for compatible substances. The first two methods were applied to the compatible substances MAHLs.

The Uniform Allocation Method distributes the "available headworks loadings" (MAHLs less the background loadings) equally amongst the SIUs in the system. This method produces a uniform set of limits for all SIUs and therefore is the most conservative.

The Industrial Contribution Method distributes the "available headworks loadings" among only those SIUs which are surcharge customers. All other SIUs are considered part of the background loadings. This method allocates the available loading to those dischargers who need it most.

However it has a smaller safety margin than the Uniform Allocation Method and requires periodic sampling of the non-surcharge customers to ensure that their effluent meets the implicit criteria of the background loadings.

The Uniform Allocation Method produced Surcharge Upper Limits between 5 and 10 times the corresponding Surcharge Threshold Level. The Industrial Contribution Method produced Surcharge Upper Limits between 20 and 40 times the corresponding Surcharge Threshold Level. The study produced the following Surcharge Upper Limits (see Table 4 below):

Table 4. Summary of Re-evaluated Threshold and Upper Limits Concentrations for Compatible Substances

Substance	Surcharge Threshold mg/l	Surcharge Upper Limit, mg/l		
		Existing	Uniform Allocation Method	Industrial Contribution Method
5-Day Biochemical Oxygen Demand	275	10,000	1,400	5,100
Chemical Oxygen Demand	825	-----	6,100	n/a
Total Suspended Solids	350	10,000	2,400	11,000
Total Phosphorous	12	500	130	520
Fats, Oils and Grease	100	2,000	970	4,500
Total Kjeldahl Nitrogen	35	-----	110	n/a

The methodology for the allocation of the limits for the Incompatible Substances is similar to that for Compatible Substances. Again five methods were considered for the allocation:

- Uniform Allocation Method
- Industrial Contribution Method
- Tiered Allocation Method
- Mass Proportion Method

- Selected Industrial Reduction Method

The first three methods were applied. In addition to the Uniform Allocation Method and the Industrial Method which are described above when discussing the Compatible Substances, the third method the Tiered Allocation Method was also used. The last two methods were found to be inapplicable to the Detroit sewer system.

The Tiered Allocation Method as adapted by MacNamee, Porter & Seely, establishes local limits as follows:

- For all Federal categorical SIUs, any pretreatment discharge standards applicable to the Substances of Concern are applied directly as user-specific "Tier I" limits.

- For all Federal categorical SIUs, of which pretreatment limits are not present for a given "Substance of Concern", as well as for all non-categorical SIUs, the "Tier II" limits are calculated using an industrial contribution-based allocation of the remaining Maximum Available Headworks Loadings, i.e. after the corresponding "Tier I" loadings are deducted.

This approach automatically grants the pretreatment discharge standard to the categorical users in preference to the non-categorical users which is generally not a problem as these users do not discharge high concentrations of the non-compatible substances.

A further consideration for the Incompatible Substances is the effects on the collection system in addition to the effects on the WWTP operations, sludge characteristics and the final effluent. This happens in two ways. The first is the potential impact on the health and safety of the operators who operate and maintain the collection system. The second is the potential impact on the structure of the collection system and its appurtenances such as risk of explosion.

The following limits were calculated and listed in Table 5 below:

Table 5. Summary of Re-evaluated Local Limits for Incompatible Substances

Substance	Existing µg/l	Uniform Allocation Method µg/l	Industrial Contribution Method µg/l	Tiered Allocation Method µg/l	
				Categorical	Non-Categorical
Inorganics					
Arsenic	1,000	990	15,000	N/A	N/A
Cadmium	2,000	280	510	*	110
Chromium (Total)	25,000	23,000	35,000	*	89,000
Copper	4,500	3,800	3,900	*	4,000
Cyanides	2,000	1,600	2,100	*	2,700
Lead	1,000	1,400	2,300	*	5,000

Substance	Existing µg/l	Uniform Allocation Method µg/l	Industrial Contribution Method µg/l	Tiered Allocation Method µg/l	
				Categorical	Non-Categorical
Mercury	5	ND	N/A	N/A	N/A
Nickel	5,000	9,500	14,000	*	26,000
Silver	2,000	510	1,100	*	1,800
Zinc	15,000	9,400	10,000	*	15,000
Beryllium	N/A	0.59	N/A	N/A	N/A
Chromium (Hexavalent)	N/A	2,400	N/A	N/A	N/A
Cobalt	N/A	32,000	N/A	N/A	N/A
Organics					
Total Phenols	500	1,400	N/A	N/A	N/A
Total Polychlorinated Biphenyls	1.0	ND	N/A	N/A	N/A
PCB Arochlor 1260	0.5	N/A	N/A	N/A	N/A
Acrylonitrile	N/A	2,600	N/A	N/A	N/A
Hexachlorobenzene	N/A	49	N/A	N/A	N/A
Octachlorostyrene	N/A	N/A	N/A	N/A	N/A
Styrene	N/A	36,000	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	N/A	48,000	N/A	N/A	N/A
Tris (2,3-Dibromopropyl) Phosphate	N/A	N/A	N/A	N/A	N/A

The concentration and loading limits presented earlier in the Tables 3 through 5 provide the basis for the revision of the Pretreatment Program on the basis of the MAHLs at the WWTP, thereby ensuring that the effluent quality at the discharge point to the receiving waters meets the criteria in the relevant permits and provides for a safe and efficient operation of the WWTP and the collection system.

1. Wastewater Discharge Control Ordinance

This ordinance is the City regulation under which discharge permits are issued and regulated for industrial dischargers. The ordinance came into force on the last day of 1996.

The ordinance defines several important things in regard to the industrial users of the DWSD sewer system. The following Table 6 summarizes the discharge limits set in the ordinance.

Table 6. Threshold Concentrations and Upper Limits in City Ordinance

Substance	Surcharge Threshold mg/l	Upper Limit mg/l
5-Day Biochemical Oxygen Demand (BOD_5)	275	10,000
Total Suspended Solids (TSS)	350	10,000
Total Phosphorous (Total-P)	12	500
Fats, Oils and Grease (FOG)	100	2,000

The surcharge threshold limits are not directly specified in the ordinance but are made by regulation as provided for in the ordinance.

2.5 PCB/Mercury Minimization Program

The DWSD is implementing a PCB and Mercury Minimization Program in response to the requirements of the organization's NPDES permit. In 1983 the DWSD's NPDES Permit expired. Since the parties involved in the permit were negotiating the conditions of the new permit, the old permit remained in force as provided in the Federal legislation governing NPDES Permits. In 1989 after lengthy negotiations between the Michigan Department of Natural Resources (MDNR) and DWSD, a new NPDES permit was issued but it remained inactive because of disputes between DWSD and MDNR on the conditions of the permit. The DWSD initiated a voluntary program for a PCB/ Mercury Minimization Program in 1990. This happened with the preparation of a submission to Michigan Water Resources Commission (MWRC) of a document outlining its program to reduce PCB and Mercury discharges to and from the DWSD sewer system. The Program was submitted to MWRC in 1991 and was designed to be in conformity with the new NPDES Permit when it would come into effect. The Program was modified after being reviewed by the MWRC and the MDNR and a Control Strategy for the PCB and Mercury Minimization Program was submitted and modified in 1992. The program started and the first annual review was prepared in 1994. The DWSD continued with its voluntary effort until the new NPDES permit came into effect in October 1997.

The initial effort by DWSD was focused on identifying the levels of PCBs and Mercury in the wastewater at several locations in the sewer system. It also sought to determine the sources of the PCBs and Mercury detected in the wastewater.
As an indication of how the emphasis of the program effort has changed, the program activities from the 1994 (the first Program Update) and the 2000 Program Updates (the most recent available) are listed below in Table 7:

Table 7. Comparison of PCB/Mercury Minimization Program between 1994 and 2000

1994 Update Current Activities	2000 Update Current Activities	Comments and Comparison
Monitoring SIUs	Monitoring SIUs	Level of monitoring and reporting detail greater in 2000.
	Evaluation of SIU Data	Extensive analysis of data presented in 2000.
	Update on SIUs with Violations	Enforcement activity described in 2000.
	Minimization and Enforcement Protocol for Mercury and PCBs	Enforcement protocol developed and implemented in 2000.
Monitoring PCB/Mercury contaminated sites	PCB/Mercury Contaminated 201 Sites Remediation	Level of monitoring and reporting detail greater in 2000.
Continuous Effluent Monitoring	WWTP Effluent Monitoring	Level of monitoring and reporting detail greater in 2000.
	WWTP Influent Monitoring	Not performed regularly in 1994.
	WWTP Sludge Analysis	Not performed regularly in 1994.
Local Limits Project	N/A, see comment	This project was completed in 1995 and is summarized elsewhere in this memorandum.
Air Deposition Project	Impact of Atmospheric Deposition and Runoff on Headworks Loading at WWTP	1998 Study determined that this was not a significant source of PCB and Mercury in wastewater.
Mercury Minimization Program for Hospitals	Mercury Minimization Program for Hospitals	Level of monitoring and reporting detail greater in 2000.
Mercury Minimization Program for Dental Facilities	N/A, see comment	Incorporated into SIU monitoring activities.
Mercury Minimization Program for Laundries	N/A, see comment	Incorporated into SIU monitoring activities.
DWSD Laboratory Control Program for Mercury	Mercury Minimization Program for Laboratories	Extended from an internal DWSD program to a service area program
Public Education and Awareness	Education/Outreach	Extensive participation by DWSD in public events in 2000 to publicize PCB/Mercury Minimization Program
Not Initiated	Industrial Pretreatment Program (IPP)	Being implemented as part of compliance with NPDES permit and PCB/Mercury program is an integral part of IPP.
Not Initiated	List of Inputs of Potential PCB and Mercury Sources	Extensive effort to make contacts and to gather information to broaden DWSDs level of expertise

Table 7 continued
Comparison of PCB/Mercury Minimization Program between 1994 and 2000

1994 Update Current Activities	2000 Update Current Activities	Comments and Comparison
Not Initiated	List of Sources with High Concentrations or Loadings of PCB and Mercury	Extensive effort to make contacts and to gather information to broaden DWSDs level of expertise
Not Initiated	Literature search and Contacts with Other Agencies on Potential PCB Sources	Extensive effort to make contacts and to gather information to broaden DWSDs level of expertise
Not Initiated	Literature search and Contacts with Other Agencies on Potential Mercury Sources	Extensive effort to make contacts and to gather information to broaden DWSDs level of expertise
1994 Update Future Activities	2000 Update Future Activities	Comments and Comparison
PCB Retirement Plans	N/A, see comment	Incorporated into SIU monitoring activities.
Spill Prevention and Cleanup Plans	N/A, see comment	Incorporated into Monitoring PCB/Mercury contaminated sites
Not Planned	Proceed with implementation efforts for new Industrial Pretreatment Program as required in NPDES permit	IWC plans to expand its activities in the monitoring of SIUs.
Not Planned	Develop recommended mercury control practices for Laboratories	IWC plans to expand its activities in identifying and educating laboratories in the handling of Mercury.
Not Planned	Update the enforcement protocol for PCBs and Mercury	IWC plans to update the enforcement protocol to improve the effectiveness of the program.
Not Planned	Continue contact with other POTWs to remain current on PCB/Mercury reduction developments elsewhere	IWC plans to widen its range of contacts with other utilities to share information.

A comparison between the 1994 and 2000 Program Updates indicates how rapidly DWSD has progressed in the administration of its PCB/ Mercury Minimization Program. The level of detail in the 2000 Program Update is substantially greater than in the 1994 Update. This is an indication of the high level of sophistication and expertise that DWSD has gained in the operation of its PCB and Mercury Minimization Program. Based on the monitoring data in the 2000 Program Update, it appears that DWSD generally has an undetectable level of PCBs and Mercury in its WWTP influent and effluent with occasional "hits" or detectable peaks in the wastewater. DWSD also has demonstrated a good record on monitoring of and enforcement on significant SIU discharges of PCBs and Mercury.

2.6 CS-1295 Pretreatment Program Database Review

This section of this memorandum is a review of documents related to an ongoing project entitled "Pretreatment Information Management System (PIMS)" being developed for the IWC Division of the DWSD. Black & Veatch Corporation (B&V) is assisting in developing the PIMS for DWSD under Contract No. CS-1295 "Pre-Treatment Program Database".

The project was initiated by DWSD in 1998. At the time of writing of this memo, B&V has produced the first draft of two documents on this project. These documents are the "Functional Requirements Specification" (September 25, 2000) and the "Development and Implementation Plan" (October 23, 2000).

The overall objective of the project is to develop an information management system that will enable the City's IWC Division to "maintain, monitor, and control the outputs of industrial users to the City's sewer system". In order to achieve this objective, the DWSD has divided the project into four phases. The above referenced documents prepared by B&V identify the first and second phases, i.e. the Needs Assessment Phase and the Scope Definition Phase respectively. The first phase of the project was completed by producing the "Pre-Treatment Program Database Request for Proposals" (DWSD, September 2, 1998) and the "Needs Assessment Report" (B&V). The two documents ("Functional Requirements Specification" and the "Development and Implementation Plan") reviewed in this section of the memo are part of the second phase, "Scope Definition". There will be two more phases to complete this project.

2.6.1. Functional Requirements Specification

This document summarizes the goals identified in the "Needs Assessment Report" and presents an overview of how these goals will be achieved. The document is explicitly stated to be subject to the approval of the DWSD and B&V. It is assumed that the document will be reviewed and discussed within DWSD and any changes agreed upon with B&V should be incorporated to produce a final version of the function requirements for PIMS.

The Functional Requirements Specification sets out five major areas for the construction and performance of PIMS

- User Management
- Permitting
- Monitoring
- Compliance
- Enforcement

Each one of the above areas consisted of the following components:

- Goals and Objectives
- Workflows
- Design Considerations

The User Management components involve maintenance of a database of industrial users discharging to the DWSD sewer system and activities associated with this database. These components are as follows:

- Maintain an inventory of Industrial Users.
- Facilitate Industrial User Classification.
- Facilitate communication/ correspondence with Industrial Users.
- Search for and retrieve Industrial User information.
- Interface with CBIS (Customer Billing and Surcharge Information System).
- Interface with GIS (Geographic Information System).
- Interface with Internet.
- Facilitate coordination of internal activities, e.g. coordination of activities within IWC, reporting to regulatory agencies, equipment logs.

The Permitting components involve activities relating to the issuance and tracking of permits to discharge given to Industrial Users:

- Generation of User Permits, i.e. ensuring that the permit templates are updated and the latest version is used.
- Maintenance of User Permit versions, i.e. maintaining a history of the permitting history of each Industrial User.
- Administrative functions relating to permitting, e.g. reminders for renewals, tracking of permit related information submitted by Industrial Users.
- Catalog and manage Industrial User requirements, i.e. keep track of sampling requirements such as locations, frequencies and pollutants to be sampled for.

The Monitoring components involve activities relating to the inspection of discharges from Industrial Users:

- Identify type and purpose of inspection activities.
- Define monitoring/ inspection activities.
- Accommodate Data from Field reports.

The following represent the Compliance components, which involve activities relating to the compliance of Industrial Users with the permit conditions imposed on them:

- Receive and manage compliance results data.
- Automatically detect noncompliance.
- Review and evaluate compliance.

The Enforcement components involve activities relating to the enforcement of the permit conditions for Industrial Users. These components are as follows:

- Manage all Enforcement Activities.
- Determine or Assist in the Determination and Tracking of Industrial User Compliance.
- Manage templates for Enforcement documents.
- Incorporate Division Operating procedures for enforcement.
- Establish and Track Penalty Payment schedules.

The Report components involve activities relating to the generation of reports for all purposes in the Industrial User Permit program:

- Provide for the flexible generation of standard and specialized (ad-hoc) reports.

2.6.2 Development and Implementation Plan

The Development and Implementation Plan provides seven integrated plans to implement all of the components described in section 2.7.1 of this memo and provides a description of how each specific aspect of these components identified in the specification can be realized. The plans are separate and can stand alone but in total they present an overall picture of how the entire PIMS project will be implemented.

The Plan states that it will be used to guide Phase 3 of the PIMS project, system development of the PIMS. The Plan is a technical document with detailed information on the hardware and software requirements for each aspect of PIMS.

There are seven detailed plans in this document as follows:

- Design and Development Plan
- Configuration Plan
- System Interface Plan
- System Architecture
- Data Conversion Plan
- Training and Documentation Plan
- Preliminary Acceptance Plan

The Design and Development Plan describes the methods that will be used to design and develop the customized components and modules of the PIMS. This is based on feedback from DWSD personnel on the specialized requirements they would like to be incorporated into PIMS.

The Configuration Plan describes the way in which the hardware and software will be set up for PIMS. This includes the items to be prepared before configuration can proceed, the actual set up of the configured system and the testing and fine tuning and training necessary after the system is configured. This work involves the Dictionary Tables that will define the data to be maintained in PIMS.

The System Interface Plan describes how the PIMS product will interface with the human users and with preexisting or planned DWSD systems. These are the Geographic Information System (GIS), the Customer Billing and Surcharge Information System (CBIS) and the Laboratory Information Management System (LIMS). In considering each legacy system, the plan describes in detail the direction of information flow between PIMS and the other systems and the format of that data. Also considered are the hardware requirements for the PIMS servers and the workstations.

The Data Conversion Plan describes the methodology for identifying data in existing IWC databases for importation into PIMS, the conversion of the data into a format suitable for importing into PIMS and the subsequent importation of the data into PIMS. Part of the work will involve reviewing all existing data in hardcopy to ascertain its accuracy and to correct it if necessary. There are eight existing databases identified; Industrial Users, Sample Requests, Sample Results, Surcharge Program, Enforcement, Spill Management, Waste Handling, System Reference.

The Training and Documentation Plan describes the manner in which the estimated 55 personnel in IWC will be trained to use the PIMS. It also addresses the documentation that will be provided to these people for later reference. Included is a description of the on-line help system that will be part of the PIMS implementation.

The Preliminary Acceptance Plan is the plan to iron out all problems and bugs in the implemented system before final acceptance by DWSD. The plan outlines establishing a set of Pass/ Fail criteria for evaluation of the system. It also foresees a period of joint operation by DWSD and B&V to ensure that all problems are uncovered and rectified.

3. Conclusions

This memorandum is concerned with the wastewater quality issues and regulatory limits and constraints in the DWSD area as it relates to the Departments SIUs. The review of the data available led to the following conclusions.

- There were insufficient data available to enable a distinction to be made between the types, strengths and volumes of industrial wastewater north and south of Eight Mile Road. Therefore and based on the actual available data a considered judgment should be made to evaluate the potential effectiveness of treatment works upstream of the Macomb/ Wayne boundary. This issue must await a reconsideration of the accessibility of the SIUs data. In a related issue, the review of the CS-1295 project offers the possibility that such data will be much more readily accessible when the project is implemented as it is scheduled to be before the end of 2001. This project will result in an easily used but powerful tool for analyzing the database of SIUs both for reporting to regulatory agencies and for better administration of the programs of the IWC Division.

- The review of the IPP shows that DWSD has been proactive on this issue since it was voluntarily initiated by DWSD in 1990. The study on the Local Limits for Compatible and Incompatible Substances provides a basis for improved administration and conditions in the issuing of discharge permits to SIUs. The PCB/ Mercury program appears to have been a success since it was started and would appear to be a model for future programs on controlling and reducing wastewater constituents that DWSD may undertake.

- A review of the statistical data contained in the Annual Statistical Summaries indicates that the variation between the maximum and minimum annual sewage volume pumped is approximately 29%. The annual volume has been relatively stable over the period 1980 to 1998 and close to the average annual volume, except for three years, i.e. from 1990 to 1992, where the annual volumes were significantly above the average.

- A review of the treatment efficiencies shows that the WWTP is capable of accepting relatively large variations in the influent concentration of the four Substances of Concern and can still discharge an effluent of a consistent quality. It should be noted that the performance of the WWTP as shown by the statistics for all four substances was not as good in the first two years of the period under study, 1980 and 1981. The figures for those two years show a much smaller reduction in the effluent concentrations than for the rest of the study period. The subsequent years indicate much less variation around the average effluent concentration.

- The study on Local Limits for Compatible and Incompatible Substances provides a rational basis for the setting of limits for various substances in the permits issued to SIUs.

- The study has established the available loadings for these substances that the WWTP can accept and still be able to meet the NPDES permit conditions for the effluent. It also established the loadings of these substances that are compatible with efficient operation of the WWTP. As a result the permits issued to SIUs in the future can be issued based on the requirements of the WWTP.

4. References

1. All DWSD "Summary of Operating Statistics of the Detroit Water and Sewerage Department" for the years 1980 – 2000.
2. All available (OPMA) "Annual Pretreatment and Sampling Reports" for 1991,1992 and 1993.
3. "Functional Requirements Specification", DWSD Contract CS-1295 "Pretreatment Information Management System", (September 25, 2000)
4. "Development and Implementation Plan", DWSD Contract CS-1295 "Pretreatment Information Management System", (October 23, 2000).
5. "Re-evaluation of Local Limitations for Compatible Substances Volume I: Maximum Allowable Headworks Loadings", (MacNamee, Porter & Seeley Inc., 1995)
6. "Re-evaluation of Local Limitations for Compatible Substances Volume II: Development of Local Limits", (MacNamee, Porter & Seeley Inc., 1995)
7. "Re-evaluation of Local Limitations for Incompatible Substances Volume I: Maximum Allowable Headworks Loadings", (MacNamee, Porter & Seeley Inc., 1995)

8. "Re-evaluation of Local Limitations for Incompatible Substances Volume II: Development of Local Limits", (MacNamee, Porter & Seeley Inc., 1995)
9. "PCB/ Mercury Minimization Program Update" for the years 1994 through 2000.
10. City of Detroit Water and Sewerage Department Industrial Waste Control Division, Ordinance 34-96 Division 3: Wastewater Discharge Control.